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Proceedings of a Meeting on Subarea 4 Witch Stock Structure

Regional Advisory Process
Maritimes Region

18 – 19 January 2001
Miramichi Boardroom
Gulf Fisheries Centre

R. O'Boyle (Chair)
Office of the Regional Advisory Process
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

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Foreword

These Proceedings are a record of a meeting of the Maritimes Regional Advisory Process, held during 18 – 19 January 2001 at the Gulf Fisheries Centre to consider the stock structure of witch in NAFO Subarea 4. They were prepared by volunteer rapporteurs and reviewed by all participants at or following the meeting. The report records as faithfully as possible the contributions and discussion that transpired at the meeting. However, the individual interpretations and opinions expressed at the meeting are not necessarily scientifically sustainable or supported by other participants. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement has been reached.

Avant-propos

Le présent compte rendu relate les travaux du Processus consultatif régional des provinces Maritimes lors de la réunion tenue les 18 et 19 janvier 2001, au Centre des pêches du Golfe, dans le but d'étudier la structure du stock de plie grise de la sous-zone 4 de l'OPANO. Il a été établi par des rapporteurs volontaires et a été examiné par tous les participants, durant ou après la réunion. Il reflète aussi fidèlement que possible les contributions et discussions des participants à cette réunion. Toutefois, les opinions et interprétations individuelles qui y sont présentées ne sont pas nécessairement soutenables sur le plan scientifique ou appuyées par les autres participants. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s'il est clairement indiqué qu'elle l'est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

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ABSTRACT

A meeting of the Maritimes Regional Advisory Process was held during 18 – 19 January 2001 at the Gulf Fisheries Centre to consider the stock structure of witch in NAFO Subarea 4. It has been known for some time that the stock structure in the Gulf was complicated and may implicate witch on the Scotian Shelf. This meeting reviewed analyses which suggested that the witch in eastern regions of NAFO Division 4T should be considered as part of the same stock as those in 4VW. While the analysis was comprehensive, the meeting considered that more information and research was required before a change in stock structure could be recommended.

RÉSUMÉ

Dans le cadre du Processus consultatif régional des Maritimes, on a tenu une réunion les 18 et 19 janvier 2001, au Centre des pêches du Golfe, pour examiner la structure du stock de plie grise de la sous-zone 4 de l'OPANO. On sait depuis quelques années que la structure du stock de plie grise dans le Golfe est complexe et qu'elle peut incorporer de la plie grise du plateau néo-écossais. La réunion a permis d'étudier les analyses selon lesquelles la plie grise de la zone est de la divisions 4T de l'OPANO devrait être considérée comme faisant partie du même stock que celui de 4VW. Bien que ces analyses soient exhaustives, les participants à la réunion ont jugé que de plus amples renseignements et recherches étaient nécessaires avant de pouvoir envisager un changement au sujet de la structure du stock.

INTRODUCTION

A meeting of the Maritimes Regional Advisory Process was held at the Gulf Fisheries Centre during 18 – 19th January 2001 to consider the stock structure of witch in NAFO Subarea 4. The meeting was held in advance of the Gulf groundfish stock assessment meeting, to be held during 27 February – 2 March 2001, to allow scientists to table assessments based on the most appropriate stock structure.

The list of attendees is given in Appendix one while the meeting remit is given in Appendix two.

J. Neilson, R. Morin, T. Shepherd, and W. Brodie were designated as external reviewers for the meeting and received a copy of the four working papers by D. Swain and J. McRuer prior to the meeting. Both Shepherd and Brodie could not attend the meeting and prepared written reviews of the working papers (Appendix three), which were discussed at the meeting. The meeting was chaired by R. O'Boyle. J. Neilson and R. Morin acted as rapporteurs on the 18th and 19th respectively.

After introductions, it was pointed out that stock structure was a major source of uncertainty in the last assessment of the 4RST witch resource, conducted in 1998. In 1995, the FRCC recommended that 4RS and 4T be combined into one unit. This recommendation appeared to be based primarily on management concerns. The chairman pointed out that if the meeting decides that a new stock structure is appropriate, it will have long-term implications and will require consultation with managers and stakeholders.

Before the review of the analysis, the chair pointed out that this meeting was a scientific review of an assessment and would not deal with allocation issues. The discussions of the meeting are confidential until its results are made public about two weeks after the meeting.

The meeting was then turned over to D. Swain and J. McRuer, who presented the analysis in the working papers. During the talk, only questions of clarification were taken. Following the presentation, the external reviewers were asked to present their comments. Then a general discussion ensued. A draft Fisheries Status Report had also been prepared by Swain and McRuer.

STOCK STRUCTURE REVIEW

Life History and Biology of Witch Flounder

While no working papers were tabled on witch life history and biology, the chairman led a general discussion on this topic to investigate a conceptual model of the witch populations in Subarea 4.

It was noted that there are ongoing genetic investigations. However, preliminary indications are that the results will not be of sufficient resolution to allow refinement of the management unit.

While it was noted that not much information on the early life history of witch flounder was available in the southern Gulf, the Scotian Shelf Ichthyoplankton Program (SSIP) had data on witch egg distributions in 1978-1982 that have been summarized in a paper by Neilsen et al. (1988), including information on distribution and timing of spawning. The paper was circulated during the course of the discussion. The relatively few mature witch flounder caught during March, July and October surveys of the Scotian Shelf in 1978 to 1982 were mostly collected in the vicinity of Western, Sable Island and Banquereau banks, with the highest density caught off Banquereau in March. Peak concentrations of witch flounder eggs were in May on Emerald and Browns banks and in August on Sable Island and Banquereau banks. Mean densities of witch flounder eggs in the SSIP surveys were comparatively low, possibly reflecting limits to the depth range sampled. The authors concluded that their data did not permit unequivocal statements concerning witch flounder stock structure.

- It is ***recommended*** that the available ichthyoplankton data be evaluated and incorporated into a conceptual model of witch flounder life history to help give context to stock structure discussions.

Tagging should be conducted on juvenile witch before they recruit to the fishery to obtain information on the extent of their movements and distribution. No tagging information was available, although it was suggested that some work done off southern Newfoundland would be of relevance to report.

Like other flatfish, the growth of flatfish is sexually dimorphic, with females growing faster than males.

- It is ***recommended*** that the impact of sexually dimorphic growth rates on inferences of stock structure be evaluated.

Concerning the identification of juvenile areas, there was a discussion of alternate data sources on egg and larval stages (e.g. SSIP data). This would entail additional work and it may not resolve any key issue. Other research efforts may be more productive: tagging studies to resolve movement patterns; age determination from otoliths to identify regional growth patterns.

Working Paper: McRuer, J., and D.P. Swain. 2001. Stock structure of witch flounder (*Glyptocephalus cynoglossus* L.) in the Gulf of St. Lawrence and on the Scotian Shelf: Evidence from spatial and seasonal variation in the fisheries for witch flounder in NAFO Division 4VW and eastern 4T. RAP Working Paper 2001/01.

- It was clarified that the distributional plots show all landings, with no selection for directed catch. However, most witch landings are from witch-directed effort.
- Participants noted that the fishery around Cape North and the Cape Breton Trough starts around mid-May. The timing shows little interannual variation. The fishery is also short-lived with the fish concentrations disappearing by mid-summer.
- Fishermen commented on the different appearance (colour, size condition) of fish in the Cape Breton Trough fishery compared with those in 4Vn, an area postulated to be the source of the fish in the eastern Gulf. It was suggested the fish in the Cape Breton Trough area appear more similar to those in the 4R fishery.
- Fishermen reiterated the observation the Cape Breton Trough fishery was short-lived each year.
- Fishermen participants noted that witch catches tend to be pure with little mixing with other species. Therefore, the fact that witch-directed landings were not selected may not be significant.
- It was suggested that it would be better not to aggregate the distributional data on 10 minute squares, since that might partially mask subtle changes in distributions relevant to a discussion of stock structure.
- The implications of management measures, including cod closures, on fishery distributions were discussed. It was concluded that much the same patterns are present, pre and post the 1993 cod closure.
- It was noted that the analysis does not seem fully complementary to the analyses of the RV data since the geographic scope of the presentation is truncated (no 4R and 4S). During the course of the discussion, additional distributional maps were tabled that showed the larger area. Due to the nature of the fishery distribution, no additional inferences were possible (no fishery in the Laurentian Channel area separating 4R from the eastern Gulf).
- A spring pulse in the witch fishery occurs from the first half of May until early June. In fall, a similar pulse occurs in the last two weeks of October.
- It was suggested that landings information by unit area by month might offer a longer term perspective as the information is available since the late 1960s.
- It was noted that the postulated seasonal movements of witch flounder seem to be entirely expected, given knowledge of other groundfish species life histories in this area.
- It was observed that the mesh size in the fishery changed from 130 diamond to 160 square from 1994 to present. It was concluded that there were no implications for the conclusions presented.
- Trends in catch and effort data for witch would be worth examining; however, this analysis cannot be undertaken before the effort data can be verified.
- There was no consensus on origin of fish in the Cape Breton Trough, but several possibilities raised. Including movement from 4Vn or 4R. However, it was noted that fisheries are

concurrent in 4R, 4Vn and Cape Breton Trough. This may suggest the occurrence of both resident and migrant populations.

- It is ***recommended*** that condition differences be researched in available data bases.

Working Paper: Swain, D.P., and J. McRuer. 2001. Diurnal variation in catchability of witch flounder (*Glyptocephalus cynoglossus* L.) to July bottom-trawl surveys of the Scotian Shelf. RAP Working Paper 2001/04.

- Fishermen noted that their experience with diel catch rates is exactly opposite from RV analyses. They experience very low catch rates at night. It was noted that this may be related to differences between commercial and research vessels in tow speed and the relative effects of herding.
- The authors clarified that no size-dependent variation was found in the patterns of diel catchability, thus the size classes were pooled.
- There was discussion of the absence of small witch flounder in 4Te (eastern 4T). The authors indicated that small witch flounder tend to occur in deeper water than that of the Cape Breton Trough.
- It was queried whether only strata that were fished both day and night were included. The authors noted that all date were included. Stratum was included as an effect in the model. Authors agreed this may be concern, but a similar approach has been used in other analyses where the results could be confirmed by comparison to results obtained by paired fishing experiments (in which the same sites were fished in both day and night). Effects tend to average out over time.
- Use of loess method to smooth data was supported. The method provides robust fits when there are outliers.

Working Paper: Swain, D.P. 2001. Length-dependent corrections for differences in fishing efficiency for witch flounder (*Glyptocephalus cynoglossus* L.) between the Western IIA and URI trawls in surveys of the northern Gulf of St. Lawrence. RAP Working Paper 2001/03.

- It was noted that nothing was said about the general fit of the models. The authors responded that most effects are highly significant. Data are somewhat sparse.
- There is a zone of overlap with the August and September RV surveys – could that provide some comparison? The authors acknowledged the possibility, but preferred to use the paired trawl data due to the large effect of spatial variation in catch rates.
- The authors noted some discontinuities in the adjusted length frequency data that corresponded with years of gear change. Such discontinuities bring the adequacy of the corrections into doub..

- Notwithstanding such concerns, the authors felt that the conclusions presented in the working papers regarding stock structure were robust to the possibility that the conversation factors were in error. Meeting participants supported this view.

Working Paper: Swain, D.P., and J. McRuer. 2001. Stock structure of witch flounder (*Glyptocephalus cynoglossus* L.) in the Gulf of St. Lawrence and on the Scotian Shelf: Evidence from spatial variation in recruitment and abundance trends. RAP Working Paper 2001/02.

- The need for this analyses at this time was questioned, noting that were some ongoing studies that may help with the resolution of the stock structure issue. The authors disagreed, noting that an assessment will be due shortly and there is a need to determine the most appropriate management unit prior to then.
- The authors noted that differences in biomass trend occurred between regions within 4RST. Participants noted that other species such as American plaice and cod show such trends as well. This requires elaboration with alternative explanations, such as broad scale environmental effects and differential mortality being given consideration. The authors concurred, noting that the other two species occur in somewhat more shallow water and might be more impacted by the Cold Intermediate Layer than witch.
- Would the seasonal surveys conducted in the Scotian Shelf in the early 1980s shed any light into possible outmigrations from the 4Vn area?
- It was noted that it would be useful to consider what are the risks of a wrong choice in this matter. Which is the faster, more productive component? If the components have different productive capabilities, what is the most risk-averse choice?
- There was a suggestion that the authors could present in the FSR a discussion of what data types relevant to a discussion of stock structure were available, and what were examined.
- It was felt that there were fairly limited data available to draw conclusions on.
- The scope of the investigation seemed somewhat limited compared to the Terms of Reference. How, for example, does 4WX fit into the postulated new management unit?

SUMMARY

The key recommendation is to create a management unit encompassing 4Twest, 4R and 4S and a separate unit, 4Teast and 4VW. Do we have sufficient information to do this; what are the implications? One concern that was raised was whether 4VW has a resident stock. This would add another dimension of complexity to the management of the resource, comparable to that of the mixed 4TVn, resident 4Vn cod fishery. In general, in spite of the extensive analyses that were presented on distributional information from fisheries and research data that were tabled, there remains considerable uncertainty as stock structure in this region. More research is required to reduce this uncertainty, given the consequences on management of this fishery. As well, it was considered that maintaining the current management structure is more precautionary

in the face of this uncertainty. Therefore, it is recommended that the current stock structure be maintained and research be pursued to fill the knowledge gaps.

- It is ***recommended*** that a zonal working group be formed to resolve witch stock structure in the 4RSTVW region and to obtain adequate funding to meet this end. Stock structure is a major issue for the management of this resource throughout the region.

- It is ***recommended*** that the two working papers on diel variations and relative fishing efficiencies be upgraded to research documents. The remaining two documents may be upgraded, at the authors' preference.

REFERENCES

Neilsen, J.D., E.M. DeBlois, and P.C.F. Hurley. 1988. Stock structure of Scotian Shelf flatfish as inferred from ichthyoplankton survey data and the geographic distribution of mature females. Can. J. Fish. Aquat. Sci. 45: 1674-1685.

Appendix 1. List of Participants

Participant	Affiliation/Address	Telephone	Fax	E-mail
C. Aucoin	NCBFVA	(902) 224-3589	(902) 224-3000	
Joe Buchanan	Fisherman	(902) 383-2951	(902) 383-2199	
Ron Cronk	NB Dept. of Agriculture, Fisheries and Aquaculture	(506) 662-7026	(506) 662-7030	
Rejean Hebert	Fisheries Management, Moncton	(506) 851-7793	(506) 851-2607	
Jeff McRuer	Marine Fish Division, Dartmouth	(902) 426-3685	9902) 426-1506	Mcruerj@mar.dfo-mpo.gc.ca
John Neilson	Marine Fish Division, St. Andrews	(506) 529-5913	(506) 529-5867	Neilsonj@mar.dfo-mpo.gc.ca
Robert O'Boyle	RAP Office, Dartmouth	(902) 426-3526	(902) 426-5435	Oboyler@mar.dfo-mpo.gc.ca
Clary Reardon	NS Dept. of Aquaculture and Fisheries	(902) 424-0349	(902) 424-1766	Reardonc@gov.ns.ca
Doug Swain	Gulf Fisheries Centre, Moncton	(506) 851-6237	(506) 851-2620	Swaind@dfo-mpo.gc.ca

Appendix 2. Meeting Remit

Background

Although witch flounder in the Gulf of St. Lawrence is currently managed as a single management unit (NAFO Div. 4RST), biomass changes in the early 1990s over the area have not occurred uniformly. Declines were sharp in 4R (western Newfoundland), 4S and western 4T, but not in eastern 4T (Cape Breton Trough). Biomass has remained low in 4S and western 4T (Estuary and Gaspé coast), and although it has increased slowly in 4R, it remains below the late 1980s levels. In contrast, biomass in eastern 4T is currently high.

Witch flounder move into the Cape Breton Trough in spring and migrate back into deeper water in the Laurentian Channel in fall. Most witch flounder occupying the Trough in summer and early fall appear to be greater than 30 cm length, and thus are likely derived from juveniles rearing in other areas. Strong year-classes of witch flounder have been produced on the eastern Scotian Shelf (NAFO Div. 4VW) in most years since the early 1990s. It is possible that witch in eastern 4T may be more closely associated with witch in 4VW than with witch in 4R, 4S and western 4T, implying a need to revise the management unit boundaries. A complication is that 4T quotas are set for witch whereas those in 4VW are set for several species of flatfish combined.

Issues

What are the appropriate witch flounder management unit boundaries in Subarea 4, based on:

- Review of scientific basis for current management units
- Location of witch flounder nursery areas, and mapping of spread of strong year-classes from these areas
- Spatial and temporal variation in size-specific abundance trends
- Spatial and temporal distribution of witch flounder fisheries
- Variation in witch flounder microsatellite DNA (if study results available)
- Other data / information as available

What changes are recommended to the current management of witch flounder?

- Is it necessary to separate witch flounder from the 4VW flatfish management unit?
- What unit areas of 4VW are implicated and during what months?
- Other changes recommended?

The advice of the meeting will be summarized in a Fisheries Status Report, with associated research document

Appendix 3. Research Recommendations

- It is ***recommended*** that the available ichthyoplankton data be evaluated and incorporated into a conceptual model of witch flounder life history to help give contact to stock structure discussions.
- It is ***recommended*** that the impact of sexually dimorphic growth rates on inferences of stock structure be evaluated.
- It is ***recommended*** that condition differences be research in available data bases.
- It is ***recommended*** that a zonal working group be formed to resolve witch stock structure in the 4RSTVW region and to obtain adequate funding to meet this end. Stock structure is a major issue for the management of this resource throughout the region.
- It is ***recommended*** that the two working papers on diel variations and relative fishing efficiencies be upgraded to research documents. The remaining two documents may be upgraded, at the authors' preference.

Appendix 4. List of Working Papers

McRuer, J., and D.P. Swain. 2001. Stock structure of witch flounder (*Glypotcephalus cynoglossus* L.) in the Gulf of St. Lawrence and on the Scotian Shelf: Evidence from spatial and season variation in the fisheries for witch flounder in NAFO Divisions 4VW and eastern 4T. RAP Working Paper 2001/01.

Swain, D.P. 2001. Length-dependent corrections for differences in fishing efficiency for witch flounder (*Glyptocephalus cynoglossus* L.) between the Western IIA and URI trawls in surveys of the northern Gulf of St. Lawrence. RAP Working Paper 2001/03.

Swain, D.P., and J. McRuer. 2001. Stock structure of witch flounder (*Glyptocephalus cynoglossus* L.) in the Gulf of St. Lawrence and on the Scotian Shelf: Evidence from spatial variation in recruitment and abundance trends. RAP Working Paper 2001/02.

Swain, D.P., and J. McRuer. 2001. Diurnal variation in catachability of witch flounder (*Glyptocephalus cynoglossus* L). to July bottom-trawl surveys of the Scotian Shelf. RAP Working Paper 2001/04.

Appendix 5. Reviewers' written comments

Comments by W. Brodie

This paper certainly is an extensive treatment of available survey data for the witch flounder stock(s) in this area. I agree with the authors' conclusions based on these data. I do have a number of questions, however, and perhaps these will be of some use to the authors in considering the stock separation issue.

- Does the movement of fish from the Northeast Scotian Shelf to the Cape Breton Trough make sense when other factors are considered (spawning, feeding, currents, etc.)?

- Why is it more likely that the fish in CBT originate on Scotian Shelf as opposed to nearby witch population(s) in the Gulf? Why wouldn't the nearby witch in 4RS also move into the CBT area?

I suspect there is not much (any?) stock ID work done on witch in this area. Probably no tagging data either. Several of the papers referenced note that witch stock structure can be very localized. Does it make sense to propose an area as large as 4VW + 4T (east)? I guess the issue of 4W is somewhat separate from the debate over 4TV.

- Any feeding studies to look at for this species and area? Is the movement of witch into CBT in summer likely a feeding migration? Any winter data to show if the larger fish hang around until spawning time?

The paper on the commercial fishery data suggest that there is a movement of witch as the authors suggest.

Comments by T. Shepherd

I agree with the authors that their results, while not providing compelling evidence, suggest that witch flounder in 4Te appear to be more closely related to those in 4VW than 4RS and western 4T. However, I think a couple issues not mentioned in the manuscript may need to be addressed.

The similar dynamics of relative catch rates between 4R/4STw and between 4Te/4VW may be because these combinations form relatively distinct populations as the authors suggest. However, underlying environmental conditions, both physical and biological, may also drive the dynamics. E.G., two distinct populations could show similar abundance trends if they are strongly affected
by common temperature conditions. It would be worthwhile to mention this possibility. As well, actually examining correlation of environmental conditions (where possible) between the areas examined may augment this work.

Information on spawning, early life history, and oceanographic features may be helpful for interpretation. The possible dispersal patterns of eggs and larvae from spawning grounds may be an important factor in determining stock structure. Specifically the question arises as to where the large fish in 4Te are spawning and in what area would juveniles likely settle. Obviously a comprehensive model of larval dispersal is beyond the scope of this study but general information on spawning locations and oceanographic conditions may suggest general settlement areas. This factor may be especially important for this species since seasonal migrations are small.